Review Paper

The Medicinal Role of *Centella Asiatica* and Its Applications in the Dahi: A Research Review

Abstract

Thankuni, scientifically known as *Centella asiatica* is a ground creeper and whole plant is used for medicinal purpose. The leaf juice is used as a good health tonic and also gives relief from hypertension, CNS and gastrointestinal diseases. Thankuni Extract is incorporated with dahi to improve the medicinal value. These properties have been ascribing to the active principles viz., Asiatic acid, Asiaticoside, madecassic acid, and madecassocide. These are pentacyclic triterpenes, found to display venous insufficiency, various vein and wound healing properties.

Key words: Central nervous system (CNS); Thankuni; Venous insufficiency and various vein.

Introduction:

Centella asiatica, commonly known as centella, Brahmi, Asiatic pennywort or Gotu kola, is a herbaceous, frost-tender perennial plant in the flowering plant family Apiaceae.[1] It is native to wetlands in Asia.[2][3] It is used as a culinary vegetable and as a medicinal herb.[1] It has been referred to in the ancient traditional Chinese Shennong Herbal about 2,000 year ago and Indian Ayurvedic medicine about 3,000 year ago. It is native to the warmer region of both hemispheres. The plant is usually found in the swampy areas of India, Sri Lanka, South Africa and Southeast Asia Such as Malaysia and Indonesia. The plant is also indigenous to China, the western South Sea Island, Australia, Madagascar, Southern United State, insular and continental tropical America. This slender and creeping herb is especially abundant in the tropical regions. The Chinese, Indian and Malays use this herb for various ailments ranging from treatment of mental disorder, Immune system deficiency, Circulatory problems, skin problem, liver aliments epilepsy, asthma, hair loss and tetanus. It is also used as brain tonic. *Centella asiatica (Linn) is* ethno medical plant use in different continents by diverse ancient culture and tribal groups. In India, It is usually described under the name of Mandukaparni in Ayurvedic system of medicine.[4]

Classification:

NOMENCLATURE	
Kingdom	Embryophyta
Subkingdom	Spermatophyta
Division	Spermatophyta
Subdivision	Angiospermae
Class	Dicotyledonae
Subclass	Rosidae
Suborder	Aralianae
Order	Araliales
Family	Apiaceae
Subfamily	Hydrocotyle
Genus	Centella
Species	*Centella asiatica*

Morphology:

Species *Centella* are small prostrate herbs rooting at the nodes, but mostly they are with stout hollow internodes. The plants usually has an aromatic smell due to the presence of essential oil or resin in its organs.[5] The leaves are alternate, but they are palmately compound. The petiole is often swollen and sheathing at the base and stipules are absent.[5] Flowers are fascicled umbels, each umbel consisting of 3-4 white to purple or pink, sessile flowers. Fruits are schizocarp with globular shape of 4 mm long.[6][7][8] It has a dehiscent seed which has a hard oily endosperm and a small embryo.[5]

C*entella asiatica* with flower

Centella asiatica growing on wet place

Centella asiatica

Vernacular name:

In India the herb is generally known by Indian pennywort. But the plant is known by different vernacular name in different parts of India and they are also known by different vernacular name in all over the world.[8][9][10] Such names are listed below.

Region/Language (In India)	Vernacular name
Hindi	Brahme-manduki, Mandookparni, Gotukola, khulakhudi
Malayalam	Kodangal, kodagam, Kutakm, kuttanal, Muthal, Muttil
Telgu	Bokkudu, Saraswataku, Saraswati plant, Bekaparnamu
Sanskrit	Bhekaparni, Brahmananduki, Manduki, Supriya, Tvasthi
Marathi	Karinga, karivana
Oriya	Thalkudi
Tripura	Thankuni, Thunimankuni
Assam	Manimuni
Bihar	Chokiora
Bombay	Karivana
Bengal	Thankuni, Tholkuri
Urdu	Brahmi
Gujarati	Barmi, Moti Brahmi
Tamil	Babassa, Vallarai
Kerala	Mayalchevi
Deccan	Vallarai
Meghalaya	Bat-meina
Sinhalaese	Hingotukola
Kanarese	Bhramisoppu, Urage, Vandelaga-illikiwigidda, Vondelaga
Manipur	Phuk
Mizoram	Lambak

Vernacular names in different regions of India

Region	Vernacular names
Bangladesh	Dhol manik
China	Fo-ti-tieng
Cook Islands	Kapu kapu
Hawai	Pohe kula
Tahiti	Tohetupou
Fiji	Totodro
Sri-Lanka	Thankuni sak
Nepal	Gho tapre
Tonga	Tono
USA	Marsh pennywort

Vernacular names in different regions of World

Ecology:

Centella asiatica ranges from sea level to high elevation. In Himalayan region, it occurs up to an altitude of 700 metre.[11] *Centella asiatica* grows very well in sandy and clay soil[12] rich in humus and organic matter. It grows within a broad range of climatic conditions but it is more abundant in those communities where secondary succession occurred.[13]

Traditional Uses:

Centella asiatica L. is a classic ethno medicinal species used by tribal groups and also by ancient civilizations. In India and other Far East countries, *Centella* is traditionally used in the form of cover crop in rubber and tea plantations. It is also one of the constituents of summer drink popularly known as "thandaayee".[14] Besides, *Centella* is generally eaten as green leafy vegetable in the form of salad and ulam among the Malay and Japanese people.[15] The salad is affluent in micronutrients comprising of vitamins and mineral and suggested to assuage micronutrient malnutrition and therefore serves as an appetizer. It can also be used as soup. Being bitter in taste due to the presence of Vellarine, it is served along with coconut milk or sometimes with sweet potatoes. In Thailand, *Centella asiatica* leaves are blended and used in the form of cordial drink[16] and also used in tea and juice.[17] In Srilanka, the leaves of *Centella Asiatica* are used as "mallung" which is a traditional curry and in the porridge known as "kolakenda" to combat malnutrition.[18] Extract of the *Centella asiatica* is also used in the production of food products, i.e. herbal noodles.[19] In China, it is used in the form of cooling drink.[20][21]

Nutritive composition of Centella asiatica:

Quantitative interpretation reveals that *Centella asiatica* comprises of high amount of water. Besides, it also serves as a good source of various macro and micronutrients, proteins and vitamins, such as ascorbic acid, thiamine and carotene. [22]

Chemical Constituents:

The chemical constituents of *Centella* plant have a very important role in medicinal and nutraceutical applications and it is believed due to its biologically active components of triterpenes saponins.[23 The triterpenes of *Centella* are composed of many compounds including Asiatic acid, Madecassic acid, Asiaticosside, Madecassoside, Brahmoside, Brahmic acid, Brahminoside, Thankiniside, Isothankunisode, Centelloside, Madasiatic acid, Centic acid, and Cenellicacid.[24] Among these triterpenes, the most important biologically active compounds are the Asiatic acid, madecassic acid, asiaticosside, Madecassoside.[25] *Centella* is also rich in vitamin C, vitamin B1, vitamin B2, niacin, carotene and vitamin A. The total ash contains chloride, sulphate, phosphate, iron, calcium, magnesium, sodium and potassium.[26][27] This nutritious porridge known as Kola kena by the Sinhalese people of Sri-Lanka. Kola kena is made with very well boiled rice, coconut milk and *C. asiatica* which liquidized.

***Centella asiatica* as medicine:**

Centella asiatica is an effective remedy for various ailments and has been used for thousands of years all over the world. The medicinal property of *C. asiatica* is becoming popular day by day throughout the world. The plant is beneficial for rheumatism, extra vitality increasing brain power, lowering blood sugar level, skin condition, increased circulation, arthritis, senility and varicose. According to Ayurveda, the herb has multifunctional properties.

Countries	Treatment
Amazonia	Memory enhancer
Brazil	Hypertension, diarrhea, urinary tract infection
Bangladesh	Dog bite, asthma, carminative tumor and wounds, itching, leucorrhoea, malaria.
China	Jaundice, nosebleeds, tonsillitis, fractures, measles, Tuberculosis, urinary difficulties.
Fiji	Childhood tidal fevers, eye problems, fractures, swollen joints, rib pain and unwanted.

Hawaii	Low immunity, Impotence, Vascular problems, Poor memory ,Heart disease
India	Leprosy, kidney trouble, ulcers, body aches, asthma, gastric, catarrh, elephantis
Sri-Lanka	Brain, endocrine gland, skin problem, blood circulation, wound healing
Malaysia	Hypertension, diarrhea, urinary tract infection
Nepal	Rheumatism, indigestion, leprosy, poor Memory
Madagascar	Leprosy, tuberculosis
Thailand	Relieve hypertension, open sores

Worldwide Ethno medical uses of *Centella asiatica*

Pharmacological Properties:

Besides these activities, *Centella asiatica* L. Is claimed to possess wide range of applications:

Wound healing effects:

Asiaticoside derived from the plant *Centella asiatica* is known to possess good wound healing activity. Enhanced healing activity has been attributed to increased collagen formation and angiogenesis. Since antioxidants have been reported to play a significant role in the wound healing process. Shukla, et. al. studied the effect of Asiaticoside on the levels of certain antioxidants in the wound so as to explore the possible involvement of such a mechanism in the asiaticosside induced wound healing. Asiaticoside application (0.2%, topical) twice daily for 7 days to excision-type cutaneous wounds in rats led to increased enzymatic and non-enzymatic antioxidants, namely superoxide dismutase (35%), catalase (67%), glutathione peroxidise (49%), vitamin E (77%) and ascorbic acid (36%) in newly formed tissues. It also resulted in a several fold decrease in lipid peroxide levels (69%) as measured in terms of thiobarbituric acid reactive substance. However, continued application for 14 days showed no significant difference in these antioxidants compared with their values in vehicle treated wound tissue. It appears from the present study that asiaticosside enhanced induction of antioxidant levels at an initial stage of healing which may be an important contributory factor in the healing properties of this substance.[28]

Antimicrobial and Antifungal Activity:

Antimicrobial activity of *Centella asiatica* plant was estimated by petroleum ether, ethanol and water extract by agar diffusion method. Zone of inhibition produced by petroleum ether,

ethanol and water extract in dose of 62.5, 125, 250, 500 and 1000 µg/ml against some selected strains was measured and compared with standard antibiotics ciprofloxacin (10µg/ml). The study demonstrated that the ethanolic extract of *Centella asiatica* has higher antimicrobial activity than petroleum ether and water extract.[29]

Antioxidant activity:

The analysis of extract from different parts of *Centella asiatica* noticed that the leaves of *Centella asiatica* exhibits higher antioxidant activity compared to other plant parts tested. The key compound for antioxidant activity was asiaticosside. The findings suggested that in different parts of *Centella asiatica* contain different amount of phytochemicals.[30] Leaves contain a higher concentration of those phytochemicals relative to the petioles and the roots.

Antiviral activity:

Crude water extracts of combinations each of *Centella* and *Mangifera indica* showed anti-herpes simplex virus activities. [31]

Antiprotozoal activity:

Alcoholic extract of entire plant showed antiprotozoal activity against *Entamoeba histolytica*.[32]

Antifilarial activity:

A mixture of ethonolic extracts of *Centella asiatica* and *Acacia auriculiformis* resulted in a considerable decrease in filarial counts in dogs naturally infected with *Dirofilaria immitis*.[33]

Memory enhancement:

In vivo studies have shown that the aqueous extract of the leaves of the *Centella asiatica* revitalize the brain and nervous system thus exhibit significant effect on learning and memory process by increasing the level of norepinephrine, dopamine and 5- HT in the brain.[34]

Cardiovascular:

In case of Postphlebitic syndrome *Centella Asiatica* decreases the number of circulating endothelial cells.[35]

Antiulcer activity:

Asiaticoside prevented development of cold induced gastric ulcers in rats. Asiaticoside administered orally to rats, significantly reduced the formation of stress induced ulcers. Extract of the plant inhibited significantly gastric ulceration induced by cold and restraint stress in Charles-Foster rats. The dose dependent reduction of gastric ulceration was associated with a dose dependent increase of the GABA level in the brain.[36] Fresh juice of the plant showed significant protection against the experimental ulcer models and the ulcer

protective effect may be due to strengthening of the mucosal defensive factors.[37] Results of the studies conducted by Abdulla *et al*,[38] also revealed protection of gastric mucosa and inhibition of leucocytes infiltration of gastric wall in rats pre-treated with *Centella asiatica* extract.

Antidiabetic activity:

Ethanolic and methanolic extracts of *C. asiatica* had shown significant protection and lowered the blood glucose levels to normal in glucose tolerance test carried out in the alloxan induced diabetic rats.[39] Nganlasom *et al,*[40] treated the wounds of the diabetic induced Male Spraque-Dawley rats with *Centella* plant extract. They found the wounds of the plant extract treated wounds epithilialised faster when compared to control.

Hepaprotective:

Titrated extract of *C. asiatica* shows positive result in curing chronic hepatic disorder.[41]

Antiproliferant activity:

Aqueous extract of *C. asiatica* along with *Psoralea corylifolia* inhibited kertinocyte replication. This effect of *C. asiatica* is due to its two constituent triterpenoid glycosides madecassoside and asiaticoside.[42]

Antidepressant:

The triterpenoid saponins present in the plant exhibit antidepressant activity by reducing corticosterone level in serum.[43]

Autoimmune:

Madecassol, component isolated from *C. asiatica* found to be efficacious in the treatment of chronic or subchronic systemic scleroderma and advanced focal scleroderma.[44]

Anticancer:

Preclinical studies have shown that methanolic extract of *C. asiatica* causes inhibition in breast cancer cells by inducing apoptosis in different cancer cell lines HeLa, HepG2 and SW48 and MCF-7. Out of which MCF-7 found to be most sensitive line for *in vitro* growth inhibitory activity which is marked by decrease in cell viability that is concentration dependent based on MTT assay.[45] Similar studies have also shown the chemo preventive potential of *C. Asiatica* extract on DMBA induced skin tumorigenesis in male Swiss albino mice. Upon oral administration *C. asiatica* (500 and 1000 mg/kg) exhibits significant decrease in the level of tumor incidence, weight, cumulative number of papillioma in comparison to carcinogen control group.[46]

Liver Protection:

The aqueous extract of *C. asiatica* significantly inhibited ethanol-induced gastric lesions and

decrease mucosal myelo peroxidase in a dose dependent manner, when the extract was given before ethanol administration. These result suggest that *C. asiatica* protected the gastric mucosa by improving the integrity of the mucosal lining while reduction of myeloperoxidase and gastric lesions could be due to decrease in the recruitement of neutrophils by *C. asiatica* or to its free radical scavenging activity.[47]

Gastric ulcer:

Ethanolic extract of *Tinospora cordifolia* and *C. asiatica* at dose of 100 mg/kg daily showed marked protective action stress induced ulceration due to adaptogenic property of mixture.[48] An extract of the herb also significantly inhibited gastric ulceration induced by cold and restraint stress in animal models. The dose dependent reduction of gastric ulceration was associated with a dose dependent increase of the GABA level in the brain.[49]

Slimming:

C. asiatica extract, caffine and L-cartine provides slimming effect in human by increasing the cyclic adenosine monophospate content with a subsequent rise in the nonesterified fatty acid content in human adipocytes.[50]

Dermatologic activity:

Crude extract of *C. asiatica* shows dermatologic activity. This activity of *C. asiatica* is due to its synergistic component Madecassocide.[50]

Radio protective activity:

Centella asiatica could be useful in preventing radiation induced behavioural changes during clinical radiotherapy. The plant extract showed radio protective properties and pre-treatment with it prior to gamma ray irradiation was found to be effective against radiation induced damage in the mouse liver.[51]

Applications:

Fermented milk and milk products have occupied a place of complacency in satisfying the palate and nutritional requirements of human being since antiquity. Fermentation is used as a method of value addition and conversion of raw materials by microorganisms and enzymes into various types of products with distinct nutritional and sensory properties. Fermented milk products, besides their nutritive value have been reported to have therapeutic properties. They are supposed to be anti-cholesterol emic, anti-carcinogenic and anti-cariogenic. Fermentation is one of the oldest food preservation technologies. A number of microorganisms associated with fermentation of milk have been shown to have health benefits to human body.[52]

Dahi (Sanskrit: Dadhi) is a popular Indian fermented milk product, which is quite analogous to plain yogurt in appearance and consistency. It is popular with consumers due to its distinctive flavor and because it is believed to have good nutritional and therapeutic value. It is utilized in various forms in many Indian culinary preparations. Dahi is consumed with rice in South India and with wheat preparations in the north; it is also used as a beverage or dessert. It is also prepared from the milk of the yak and the zomo in the Himalayas.[53] Dahi is still made by local halwais, shops, and restaurants and in homes by traditional methods. Some dairies have started its commercial manufacture in India.

Dahi is an indigenous Indian fermented milk product known for its stimulating taste, palatability and curative values also called as 'curd'. It is yoghurt like product made in India and neighbouring countries. About 7% of the total milk produced in India is transformed into fermented milk products.[54] According to Bureau of Indian Standards (BIS) (1980)[55], Dahi is a product obtained by lactic fermentation of cow or buffalo milk or mixed milk through the action of single or mixed strains of lactic acid bacteria or by lactic acid fermentation accompanied by alcoholic fermentation by yeast. As per PFA rules, (1988)[56], dahi or curd is a product obtained from pasteurized or boiled milk fermented with a culture. The different starter culture used in the manufacture of dahi includes *Lactococcus Lactis, Lactobaccilus cremoris, Streptococcus thermophilus, Lactobacillus bulgaricus, Lactobacillus*. Plant arum and lactose fermenting yeasts. A good quality dahi is of firm and uniform consistency with a sweet aroma and clean acid taste. It should be with smooth and glossy surface, and a cut surface is trim and free from cracks and air bubbles. Dahi is a very nourishing food and is a source of protein, essential vitamin, minerals calcium and riboflavin.

Further Benefits:

In the present time, researches on plants have been enthralled throughout the world to emblematize the tremendous potential of medicinal plants. Medicinal plants are the important source of life saving drug for 80% of world's population which constitutes a vast, undocumented and overexploited economic resource not only in the form of traditional medicine but also as trade commodities. In recent years, due to its wide prospects and potential, its demand has led to a quantum increase which plays a vital role in alleviating human sufferings due to lesser side effects, easy availability at affordable cost and being non-narcotic. Sometimes, it is the only source of health care available to the poor. *Centella asiatica* has a long history of traditional use for a wide range of disease. Much of the

traditional uses have been validated by scientific research. Many research studies have demonstrated its different functional properties like wound healing effect, *Antimicrobial and Antifungal Activity, Antioxidant activity, Antiviral activity, Antiprotozoal activity, Antifilarial activity, Memory enhancement, Cardiovascular, Antiulcer activity, Antidiabetic activity, Hepaprotective, Antiproliferant activity, Antidepressant, Autoimmune, Anticancer, Liver Protection, Gastric ulcer, Slimming, Dermatologic activity and Radio protective activity*. With a very low toxicity as attested by its long popular use as a natural product, *Centella* can be a potential herbal plant in many healthcare applications.

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